PCs get smarter
PAGE 35

Software battles ahead
PAGE 49

Taking on Intel
PAGE 43

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Electronic Business®

FOR THE MANAGEMENT TEAM IN ELECTRONICS, COMPUTER, AND SYSTEMS COMPANIES—WORLDWIDE

JULY 8, 1991

Compaq's ACE in the workstation wars

PAGE 28

Electronic Business

FOR THE MANAGEMENT TEAM IN ELECTRONICS, COMPUTER, AND SYSTEMS COMPANIES WORLDWIDE

VOLUME 17, NUMBER 13 JULY 8, 1991

Cover: Don Glentzer

PAGE 28 Compaq CEO Rod Canion predicts that by moving into workstation architectures, the company will eventually double in size

COVER STORY

28 New alliances promise to reshape the desktop

So far, the Advanced Computing Environment, or ACE, has been little more than a mere war of words. While ACE promises to revamp the PC and workstation markets by linking Compaq, Microsoft, Digital Equipment, Mips Computer Systems, The Santa Cruz Operation, and Silicon Graphics, the battle plan is still far from clear. This special report assesses ACE's big guns, their stakes in the alliance, and how they plan to change the computer industry

UPFRONT

Business Trends

11 Bentsen spurs backlash against Sematech; semi equipment makers are optimistic; is Sun-Orcad deal a bad omen for PC-based EDA?; Lex and Arrow merge electronics operations; megafabs pose threat to small players; the chip of the future; software execs upbeat on economic outlook; PC industry continues price wars; Apple's System 7 finally hits the market; hotels flop with laptop users; whatever happened to profit growth?

Companies to watch

19 Quadtech buys GenRad's test and measurement division; NVision offers high-definition audio systems; Talarian helps users sort out complex data

Business Barometer

21 Profits
Profits keep falling but should recover in 1992

22 Leading Indicator
Leading Indicator gains ground in April

PAGE 28 The ACE initiative may change the financial orbit of the computer industry

PAGE 43 Mips's president and CEO Robert Miller declines to specify direction of future chips

PAGE 57 Stephen Wong, marketing director of Apple Hong Kong is hoping that Apple's revenue will rise

FEATURES

SPECIAL REPORT

35 **The battle for the desktop**
Even before ACE, the line between PCs and workstations was becoming less and less distinct. Now the alliance has put Compaq on a collision course with workstation powerhouse Sun. Compaq's success will depend largely on whether ACE turns out to be more than just another bit of empty rhetoric

43 **RISC chips head for the mainstream**
For now, Intel can afford to dismiss ACE as a "tempest in a teapot." But others take a less breezy view. If the alliance succeeds, it will be a "slap in the face" for the microprocessor giant and a new lease on life for little Mips Computer Systems. It's now up to Intel to make the next move

49 **Building a PC/workstation software bridge**
Behind the facade of smiling faces and cheerful executives, ACE consists of a variety of plots, hidden agendas, and new alliances. In any case, it's hard to argue with one analyst's view that ACE makes Microsoft "the most powerful company in the computer industry"

International

53 **Will Europe's protectionists yield to the free marketers?**
Until recently, most European governments had a unique solution for their faltering electronics companies: another slug of cash. But with 1992 in view, the policy makers in Brussels are ruling against such anticompetitive policies. Instead, European electronics companies must find new ways —including alliances with outsiders—to stand on their own

57 **Apple's low-cost strategy pays off in Asia**
In what many analysts call a "rebirth," Apple Computer has gambled big on a new production

DEPARTMENTS

5 Inside Business
Tracking the flight of the ACE alliance

62 Advertiser Index
An index of the advertisers and their agencies covered in this issue

62 Companies in this issue
An index of the companies covered in this issue

63 My View
Rip city

64 Viewpoint
The three p's of a start-up

EDITORIAL STAFF

Publisher: Frank J. Burge

Editor: Jeffrey Bairstow

Managing Editor: H. Garrett DeYoung

Senior Editors: Linda Stallmann (Financial), Rick Whiting, Barbara N. Berkman, Teri Sprackland, Elizabeth B. Baatz

Associate Editors: Peter L. Burrows, David Webb

Assistant Editors: Barbara Jorgensen, Xiong Xiaoge

Copy Editor: Elaine M. Cummings

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Consulting Editors: Alberto Socolovsky, Allen Furst, Lewis H. Young

Senior Production Editor: Karen J. Covey

Assistant Production Editor: Maura A. Baker

Editorial Assistant: Jean O'Brien

ART STAFF

Art Director: Michael Roach

Associate Art Director: Elizabeth Zisa

Staff Artist: Michele G. Kane

EDITORIAL OFFICES

Boston: Cahners Building
275 Washington Street, Newton, MA 02158
(617) 964-3030 Telex: 94 0573 CPC BSN
Fax: (617) 558-4327 MCI: EBBOS

San Jose, Calif.: Teri Sprackland, David Webb
Sherman Building, 3031 Tisch Way, Suite 100,
San Jose, CA 95128 (408) 243-8838

Northwest: Dwight B. Davis
2924 Queen Anne Ave., N.
Seattle, WA 98109 (206) 284-5130

London: Barbara N. Berkman
27 Paul Street
London EC2A4JU England 011-44-71-628-7030
Fax: 011-44-71-628-5984

PRODUCTION

VP Production: Wayne Hulitzky

Director of Production/Manufacturing: John R. Sanders

Production Supervisor: Andrew A. Jantz

Production Assistant: Julie T. Kohn; (617) 964-3030

CIRCULATION

Circulation Manager: Ann Ward
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Tracking the flight of the ACE alliance

MAKING SENSE of the computer industry's galaxy of strategic alliances is like studying the competing cosmologies of medieval philosophers: It's easy to get lost in the details. But when such supernovae as Compaq Computer, Microsoft, and DEC appear to be moving into conjunction, the economic consequences are urgent enough to warrant a serious examination.

Senior editor Teri Sprackland

The Advanced Computing Environment alliance is an important phenomenon, whether you view it as "The Universe According to Compaq" or "When Workstation and PC Worlds Collide." In this issue, editors Teri Sprackland, Dave Webb, Elizabeth Baatz, and Rick Whiting, joined by contributing editor Dwight Davis, explore ACE in a four-dimensional special report that covers its effect on the chip, software, and systems markets, as well as analyzing the strategy of Compaq and its allies.

For chip makers, there's a large element of risk in the ACE initiative. Intel Corp. executives like to play down the challenge posed by an adoption of Mips Computer Systems' chip architecture. But industry analysts aren't taking the decision lightly; they see the choice of Mips's chips as part of a migration by Compaq and others to a higher-end world where the PC/workstation boundaries blur and the challenge to Intel's hegemony may be very real indeed.

To achieve their goal of a new desktop computing standard, the 21 companies endorsing ACE must somehow cut through the competition between operating system software. As our editors discovered, that won't be easy. Two OS alternatives are on the table—one from Microsoft and one from The Santa Cruz Operation—and the long-standing battle between adherents of Microsoft's OS/2 and Unix continues unabated by the ACE alliance.

Whatever the challenges and pitfalls, support for the ACE initiative is a necessary path out of the saturated commodity-style PC market. The world of sophisticated workstation-type technology is not a friendly place to play catch-up, especially in the face of competition from companies such as Sun Microsystems. Still, it may be a friendlier place than a DOS-based PC market where price tags, profit margins, and stock prices all feel the pull of gravity.

With ACE, "everybody wins," enthuses one Wall Street analyst. That's a cosmic statement that will bear watching in the months ahead.

—John Parker, contributing editor

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BPA ABP

COMPETITIVENESS

Bentsen spurs backlash against Sematech

IF SEMATECH was spoiling for a fight, it got one. At a recent joint press conference with Sen. Lloyd Bentsen (D-Tex.), the U.S. chip consortium spotlighted an issue that has been quietly debated for years—that Japanese semiconductor equipment makers deliberately withhold key technology from their U.S. customers to make them less competitive.

Bentsen, who is sponsoring a Government Accounting Office report on the topic, couldn't provide any evidence of the allegations and wouldn't name names. But Sematech officials fingered some of the largest equipment companies in the world, including Nikon and Canon.

Sematech's accusations weren't well received. Not only were they flatly denied by Japanese companies, but even some U.S. industry executives said the issue was an old one and not that unusual. Others wondered if the allegations were spurred by self-interest, since the consortium faces a tough battle with the White House for renewal next year.

Craig Barrett, executive vice president of Intel, said that he had heard stories of Nikon not selling its latest equipment but that he wasn't sure if the Japanese company's actions were any different from those a U.S. company would take. If products are scarce or early in their life cycles, he admitted, Intel might favor its best customers. "Maybe that's what they are doing," he said.

There is no doubt that the U.S. equipment industry is suffering a steep decline in worldwide market share, mostly at the hands of the Japanese. A recent report from the U.S. Commerce Department showed that the U.S. share of the equipment business dropped from 75% in 1980 to 49% in 1988, while Japan's share increased from 18% to 39% during the same period. But Barrett and others claim that the problems of the U.S. equipment industry can't be solved by pointing fingers at Japan.

Bentsen: Japan is withholding leading-edge IC technology from U.S. customers

This is not the first time Sematech has been outspoken on an industry issue. But while the charges that Japan withheld technology might have been true in the past, says one industry source, "it isn't helping the industry now to bring them up again. Sematech was trying to help itself."

—*Valerie Rice*

SEMICONDUCTOR EQUIPMENT

The deliberately optimistic semi equipment makers

EVEN WHILE embroiled in the Bentsen-spurred semiconductor equipment controversy, U.S. and Japanese equipment manufacturers predict an optimistic future for their respective industries.

According to the first-ever release of public data, U.S.-based trade association Semiconductor Equipment and Materials International and the Semiconductor Equipment Association of Japan jointly announced that total worldwide equipment sales rose 17.8% to $2.47 billion in the first quarter of 1991, more than reversing the prior quarter's 6.8% decline. Mask/reticle equipment and other facility-related equipment sales lead the pack with first-quarter gains of more than 40%.

Slower growth equipment categories in early 1991 included wafer process equipment, up 18.9% from year-end 1989; wafer manufacturing equipment, up 7.9%; and assembly equipment shipments, up a meager 0.9%. These statistics are now being released quarterly as part of an agreement to collect and combine data of both the U.S. and Japan equipment trade associations.

Sales in the equipment industry, which generally lag semiconductor device sales, will experience only slow growth in 1991, despite the first-quarter boost. But unlike past recessions, when orders were built up and dropped unexpectedly, the current slowdown has been characterized by more predictable order patterns.

A measured, deliberate optimism may continue to be the equipment industry's attitude for the rest of 1991. For next year, most equipment company executives appear to be relaxing their guarded outlook and are

First-quarter rebound across the board

Semiconductor equipment worldwide shipments
($ millions)

	Shipments	Change from previous quarter
All equipment	$2,471	17.8%
Wafer process equipment	1,478	18.9
Test equipment	543	13.3
Assembly equipment	201	0.9
Other facility related	153	47.4
Mask/reticle equipment	68	44.9
Wafer manufacturing equipment	28	7.9

Source: SEMI and SEAJ

gearing up for happy days again. Whether or not the tremendous capital costs of large-die plants will put a crimp in these hopeful plans remains to be seen.

—Elizabeth B. Baatz

DESIGN AUTOMATION

Is Sun-Orcad deal a bad omen for PC-based EDA?

SUN MICROSYSTEMS just added a key application in its furious race to market its Sparc computing architecture as a new standard for low-end technical computing. In May, Sun announced that Hillsboro, Ore.-based Orcad will make its electronic design automation products available on the Unix-based Sparc platform. The companies say the relationship could earn Sun $350 million and Orcad $150 million over the next five years.

Sun figures the deal translates to 45,000 units sold by 1995. "This is our single biggest design win of the year," says James C. Blaschke, Sun's director for technical markets. "Maybe our biggest ever."

The move upmarket by Orcad, which until now sold only low-cost DOS-based PC software, has somber implications for the PC-based technical software industry. Orcad, claiming the largest EDA installed base in the world with 60,000 seats, has always sworn it would not make the move to the Unix-based world of workstations, which it and others have long considered too expensive and too sophisticated for the average engineer. "We're eating some serious crow," says Joe Tanous, Orcad VP for sales and marketing.

Orcad is not alone. Rapidly falling workstation prices—and the resulting interest from customers attracted to that platform's superior speed and networking—is proving irresistible to a wide range of software vendors who grew up on the PC. While about half of all EDA is still done on PCs, the Technology Research Group in Boston expects that to fall to 40% by 1994. Orcad figures that half of its sales will be to Unix users by 1995.

But EDA on DOS isn't dead yet. Research firm Daratech points out that the huge popularity of Microsoft's Windows 3.0—a user interface that gives the PC platform some Unix-like characteristics—promises years of continued growth in DOS machines. Microsoft sold about 3 million copies of Windows 3.0 in the product's first six months on the market, says Daratech—a figure that dwarfs the total number of Unix workstations *ever* sold.

—Peter Burrows

STRATEGIES

Lex and Arrow merge

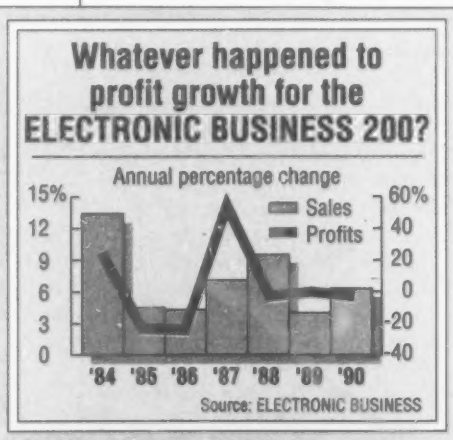
THE CONSOLIDATION of U.S. electronics distribution advanced last month when Arrow and Lex (the second- and third-largest players, respectively) announced a merger of their electronics operations.

Arrow now displaces Avnet as the U.S. leader in electronics distribution, with 1991 sales estimated at $1.7 billion, and further extends its reach into Europe. Lex's parent company, Britain-based Lex Service, exits electronics entirely to focus on automobile distribution (which accounts for 70% of its business) while retaining a one-third stake in the combined operation. Analysts say the merger is good for the industry. "There [have been] too many distributors selling too many product lines," notes veteran observer Clarke Walser of The Chicago Corp.

Arrow CEO Stephen Kaufman expects the merger will accomplish considerable economies of scale for the two companies and give the new company tremendous clout. But the merger also brings under one umbrella products from all major U.S. semiconductor producers, a group notorious for not sharing shelf space. Kaufman has said that he doesn't expect any line-card conflicts, but Walser isn't so sure. "There are obvious conflicts with both semiconductors and passives," he says. "It seems to me that either Motorola or National will have to reverse their field on who they share shelf space with." If not, it will mean a loss of some business for Arrow.

So far, suppliers are taking a wait-and-see approach. AMD has long been a supplier for both companies, and distribution director Al Frugaletti notes Arrow's smooth merger with Kierulff. Still, Frugaletti predicts there will be line-card adjustments. "You've got to know where to draw the line or the customer will do it," he warns.

The merger did not include Lex's operations in Continental Europe, although Kaufman says he may bid



The 200 largest U.S.-owned electronics companies sold $362.3 billion worth of products and services last year, up 6.3% from 1989. But while sales growth improved last year, net income growth deteriorated for the third year in a row. In fact, income for the top 200 companies has fallen in five of the past seven years. Stay tuned: The next issue of ELECTRONIC BUSINESS will feature our exclusive top 200 ranking of U.S. electronics companies.

—Elizabeth B. Baatz

on them in the future. However, notes Walser, "Avnet has made no secret about the fact that they want to move into Europe."

—Barbara Jorgensen

SEMICONDUCTORS

Mega-fabs pose threat to small players

SMALL AND MIDSIZE chip manufacturers take note: In just nine years you may be priced right out of the market.

According to a report from the National Advisory Committee on Semiconductors' Micro Tech 2000 Conference, the fab of the future will cost $2 billion and could number as few as five in the United States. If so, small and midsize chip companies with their own fabs might be squeezed out, and only the largest companies will be able to pay for the privilege of manufacturing. In fact, these fabs will be so expensive that some question whether any U.S. company will be able to pay the price.

But while NACS stressed that the Micro Tech proposal was just one suggestion to aid the U.S. competitive stance with Japan, some sources believe that the "mega-fab" idea was the wrong direction to take. Arguing that the healthiest part of the chip industry is in small companies, many said the industry should concentrate on smaller, flexible fabs that could be altered quickly and cheaply. Others said the push to develop new technologies ignores what is really wrong—scarce working capital.

NACS chairman Ian Ross said the proposal would not force small companies out but instead would make them work more closely—perhaps by joining together to own a fab.

—Valerie Rice

The chip of the future

NACS recently hosted the Micro Tech 2000 Conference to draw a road map that would put the U.S. chip industry on a par with Japan by the year 2000. The aim is to put the power of a supercomputer on a single chip. Among the findings:

- Fabs will cost $2 billion and produce 10,000 wafers per week;
- The industry will need 0.1 micron chip equipment;
- A state-of-the-art chip will have three layers of circuits, 100 million transistors, and operate at 300 to 400 megahertz. (Today's average is 20 to 25 MHz and 1 million transistors).

—Valerie Rice

COMPUTERS

Of price wars and PCs

IF THE REASONS for the PC price wars of late weren't evident before Spring Comdex, visitors to the Atlanta show left with no doubts: The number of PC clone makers is growing, especially in the notebook and laptop segments.

With so many vendors with essentially the same offerings, it isn't hard to figure out why PC prices have plummeted in the past three months. Industry leaders IBM, Apple, and Compaq all slashed prices by up to 35% since last year to steal market share from the lower-priced products from second- and third-tier clone makers. In turn, the clone makers have, themselves, been trying to boost market share at the expense of margins. And since customers see they can get essentially the same products—in some cases, better—at lower prices, top-tier companies had no choice but to react. But those price cuts mean dramatically lower gross profit margins, signaling either a slowdown in hardware development or serious consequences to the bottom lines of each of the three industry leaders.

Meanwhile, second- and third-tier companies that have been beating IBM and Compaq out of commercial accounts (such as AST Research and Dell Computer) must also lower prices. That puts more pressure on already tight margins and threatens the ability to compete mainly on a lower-price basis.

Of the several dozen vendors now testing the waters of the $36 billion PC marketplace, two kinds of vendors are likely to survive the price bloodletting: those that find markets for PC innovation and those that can build at the lowest costs (which typically means the highest volumes). In both cases, survivors must have distribution schemes that rely less upon commercial distributors and more on direct sales and so-called computer "superstores."

Spring Comdex highlighted another subtler facet of the PC marketplace—the presence of an ever-higher number of Asian vendors in the United States. If manufacturing is, indeed, a cornerstone to success in this systems market, U.S. vendors haven't seen anything yet.

—By Dave Webb

SOFTWARE

Software execs upbeat on economic outlook

UNLIKE OTHER SEGMENTS of the computer industry, where executives are wringing their hands, cutting prices, and laying off employees, software company executives expect to show financial gains this year over 1990.

A survey of 380 software company CEOs and CFOs conducted in March by Adapso, an Arlington, Va., computer software and services trade as-

sociation, found that 84% of them expect 1991 sales and profits to exceed last year's. "As a whole, the software industry is moving ahead despite the current economic slowdown," says Douglas Jerger, vice president of Adapso's Software Industry Division.

The survey did indicate that things are not as good as they could be. Fifty-eight percent of the respondents said the current economic climate would affect them "somewhat negatively," while 42% said customers are taking longer to pay for products and services. The survey also disclosed that vendors of microcomputer software are faring much better than those who market software for minicomputers and mainframes.

Sixteen percent of the responding executives said they expect their company to undertake some cost-cutting measures this year. Of those, 41% plan to cut staff and 37% plan to cut advertising and marketing-related expenditures.

—Rick Whiting

OPERATING SYSTEMS

Will Apple's System 7 block the Windows onslaught?

APPLE COMPUTER'S history of crying wolf over the arrival of its System 7 Macintosh operating system took a lot of steam out of the system's actual debut last month. Apple began talking publicly about System 7 in 1989, and has since pushed back its delivery date several times.

Now that it's here, there are concerns that Apple is too late to stem the tide of Mac users converting to Windows-enabled, user-friendly PCs. Microsoft's success with Windows 3.0 has been nothing short of spectacular, forcing that company to recalibrate its OS/2 commitment and spawning an epidemic of new Windows-based DOS applications.

System 7, for its part, doesn't appear to have the installed-base leverage of Windows, and not only because the sheer numbers of DOS machines dwarf the Macintosh installed base. Since many older Macs aren't easily upgraded to System 7, it could prove ineffective as a sandbag to stop any significant flow of conversions to cheaper, applications-rich Windows-based PCs. Among other things, System 7 requires a hard disk drive and at least two Mbytes of RAM.

Still, System 7 is a hefty weapon for Apple. By fall, several applications from top-name software vendors—Microsoft, Venture Software, and T/Maker—will have System 7-optimized software packages on the market. The Windows tide may be cresting, but Apple will have to prove that System 7 is more than just a sandbag.

—By Dave Webb

COMMUNICATIONS

Hotels get low marks from laptop users

WITH LAPTOP computers becoming as popular and easy to use as car phones, executives on the go can now log on with the home office from just about anywhere—anywhere, that is, except the average hotel room. In fact, less than 40% of hotel rooms in the United States are "modem ready," according to a survey by the Association for Computer Training and Support.

As a result, says ACTS director Elliott Masie, data-starved managers on the road often must resort to their own wits and engineering skills to plug themselves into hotel phone systems. One survey respondent claims to routinely spend about an hour moving beds and dressers, taking phones apart, and crawling around on the floor to open up baseboard outlets. Another once had to run a phone line down the hall and into a storeroom to find a line that didn't go through the front desk. Yet another had to call for help when he became wedged under the bed while hooking up his computer.

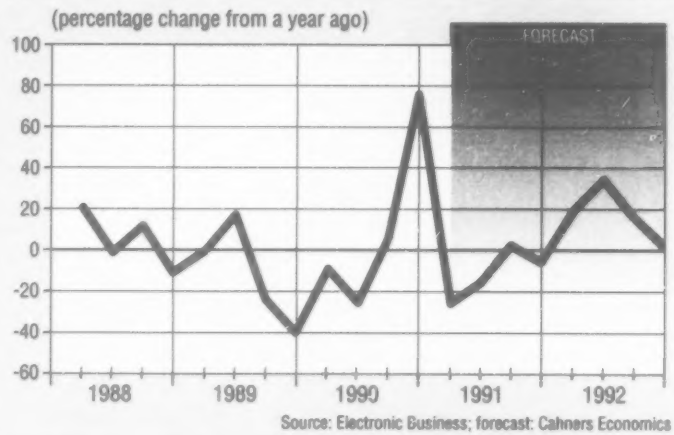
Worse yet, says Masie, only 2 out of 15 chains can identify which of their hotels have modular plugs in the rooms. Interestingly, economy chains such as Red Roof and Budget-Tel seem to be better informed on the subject than such biggies as Hyatt and Holiday Inn.

ACTS has requested that all U.S. hotel chains provide travel agents with information on the modem capabilities of each of their properties by year-end. Masie also has "challenged" the chains to install modular plugs or adapters in every room by the end of 1992. In the meantime, ACTS suggest that business travelers carry an "emergency kit," including a screwdriver, phone extension cords, and alligator clips.

For a free copy of the ACTS report, *Traveling with a Laptop Computer*, send a stamped self-addressed envelope to ACTS, 27 Sagamore Rd., Raquette Lake, NY 13436.

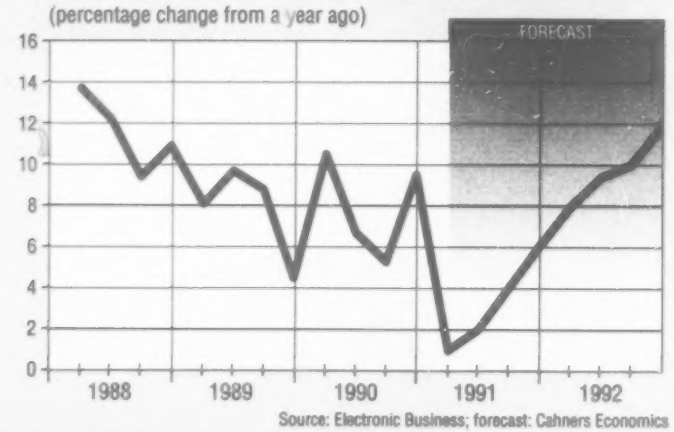
—H. Garrett DeYoung

Electronics profits take a hit in early 1991...



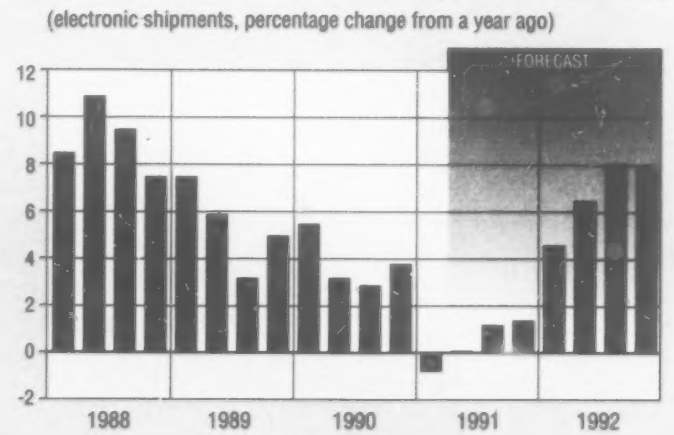
Source: Electronic Business; forecast: Cahners Economics

...as revenue growth slows dramatically...



Source: Electronic Business; forecast: Cahners Economics

...but relief is in sight for 1992



Source: Commerce Dept.; forecast: Cahners Economics

Profits plummet now but will recover in '92

FOR EVERY UPTURN, there is a downturn. That has never been truer for the electronics industry. After soaring 79% in the fourth quarter of 1990 compared with a year earlier, profits headed south in early 1991. According to ELECTRONIC BUSINESS's composite profits index, company profits on average fell 25% below year-ago levels in the first three months of this year. Discounting the seasonal trend in profits, the latest slump is in response to slow sales.

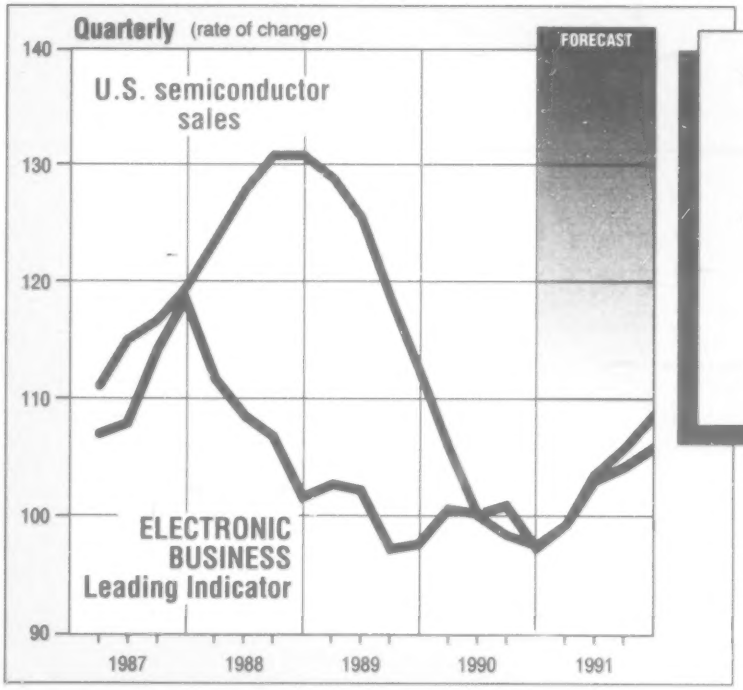
Total shipments of U.S. electronics products fell 0.8% in the first quarter below the same period last year, the first decline recorded since the electronics industry recession in the fourth quarter of 1986. Digital Equipment Corp.'s analysis sums it up best: "The difficult economic environment is still with us. An uncertain business outlook, heightened by the Middle East conflict, is causing delays in customers' investments in technology, particularly for large systems."

When can electronics companies expect a rebound in profits? Soon, if the EBLI continues on its upward path. Further, while domestic orders for electronics remained weak, most companies report gains abroad, which should help sustain earnings until an expansion resumes at home. Meanwhile, electronics companies are reporting more restructuring and labor cuts to reduce operating costs, the benefits of which will emerge in 1992 when profits are forecast to rise 15.5%, in contrast to a decline of 9.6% in 1991. For every downturn, fortunately, there is an upturn.

—John Farrell

For more information on Cahners Economics, contact Dan Buchan at (617) 630-2105, by fax at (617) 630-2100, or write Cahners Economics, 275 Washington St., Newton, MA, 02158-1630

ELECTRONIC BUSINESS Leading Indicator confirms recovery in April



Plant and equipment orders remain weak

Source: Commerce Dept.

Leading indicator gains strong foothold in April

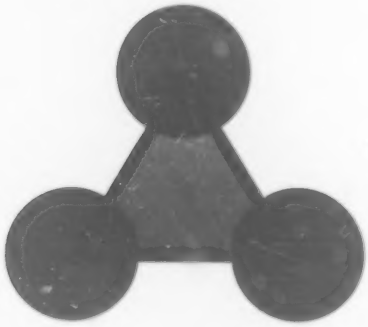
THE ELECTRONIC BUSINESS Leading Indicator climbed from 101.7 in March to 103.2 in April. The strong showing clearly points now to a recovery ahead in the electronics industry. All components of EBLI rose in April except contracts and orders for new plants and equipment. Cahners Economics predicts EBLI will rise slowly to a new peak of 109.5 in June 1992.

EBLI is a weighted composite of six statistics that tend to lead activity in the electronics industry. To obtain your complimentary background paper, contact Cahners Economics, 275 Washington St., Newton, MA 02158-1630, USA; telephone (617) 630-2119; fax (617) 630-2100.

	Latest month	Previous month	Year ago	1990 average
ELECTRONIC BUSINESS Leading Indicator (rate of change, Apr.)	103.2	101.7	100.1	99.8
U.S. semiconductor bookings ($ millions, 3-month average, Apr.)	$1,448	$1,363	$1,366	$1,254
Weekly hours of semiconductor production workers (monthly average, Mar.)	41.1	40.1	40.1	40.4
Electronic components lead time index (1977 = 100, May)	93.3	88.6	87.3	80.7
S&P's semiconductor stock price index (1970 =10, monthly average, Apr.)	74.8	70.6	67.8	64.6
Change in electronic components inventories ($ millions, SA, Mar.)	-$23	-$207	$112	$33
Contracts and orders for plant and equipment ($ billions, SA, Mar.)	$33.4	$37.3	$41.3	$38.2

SA = seasonally adjusted; all other data are not seasonally adjusted

Sources: Semiconductor Industry Association, Bureau of Labor Statistics, *Electronics Purchasing*, Standard & Poor's, Commerce Dept., Bureau of Economic Analysis



New alliances promise to reshape the desktop

Among its other goals, the ACE consortium is seen by some as a move to "get Sun and keep Intel honest"

By Teri Sprackland

So far, the Advanced Computing E vironment (ACE) alliance, whi some proclaim as the opening in the battle between PC and wor station contingents, has been litt more than a war of words.

"Those who can, do. Those who can't, t sort," said Scott McNealy, CEO of Su Microsystems Inc., the Mountain View, Cali based workstation leader. At the Hambrec and Quist Technology Conference in San Fra cisco, ACE was dismissed by at least o source as just another "rite of spring," a refe ence to a long line of generally ineffective in dustry groups. The consortium was seen a an effort by Compaq Computer, Digital Equip ment, Silicon Graphics, Microsoft, Mips Com puter Systems, and others to "get Sun and keep Intel honest."

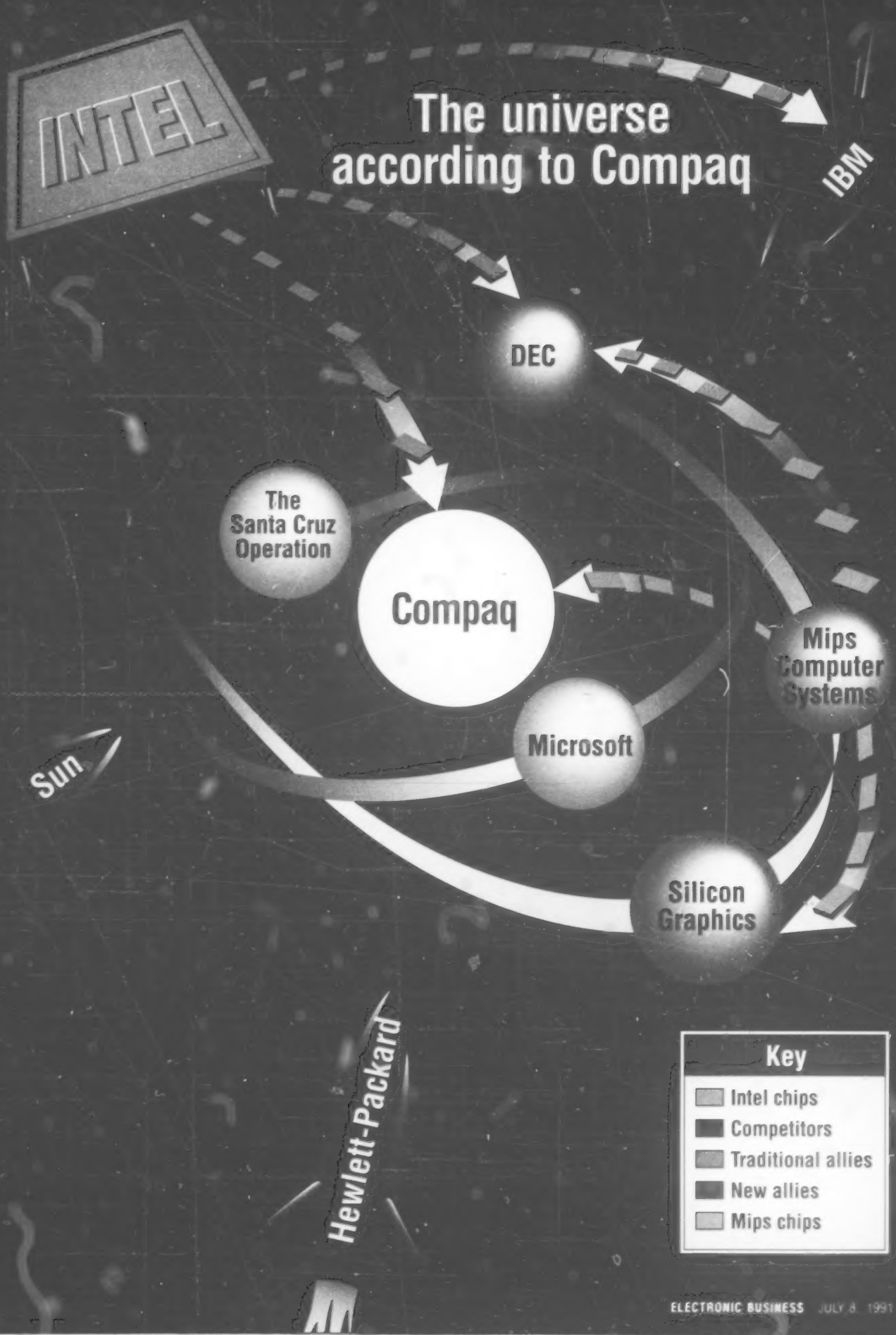
Those comments acknowledge two facts of life that now characterize the electronics in dustry. The first is the bridging of the techni cal and marketing gaps that have long separated PCs and workstations. The differences between the two classes of ma chines range from the arcane to the obvi ous, but a fundamental similarity is emerg ing: Both are designed to be used by indi

Financial orbits

The ACE initiative has restructured a tangl of suppliers, competitors, and customers. Compaq's oldest allies still remain close, b new allies are now in closer orbit. Watching closely from the outside is Intel, which remain a chip supplier to both sides. Competitors HP Sun, and IBM, however, are aiming to blow a few holes in Compaq's universe.

Equity stakes provide gravitational pull fo ACE members:

- DEC holds a 5% stake in Mips;
- Compaq holds a 13% stake in Silicon Graphic
- Microsoft holds a 20% stake in SCO.


The universe according to Compaq
INTEL
IBM
DEC
The Santa Cruz Operation
Compaq
Mips Computer Systems
Microsoft
Sun
Silicon Graphics
Hewlett-Packard
Key
Intel chips
Competitors
Traditional allies
New allies
Mips chips

Consortium founders: Microsoft's Gates, Compaq's Canion, Mips's Miller, DEC's Olsen, and SCO's Michels

viduals at their desks.

The second fact of life is the growing discomfort among microprocessor users held virtually captive by Intel Corp. To be strategically vulnerable to one supplier—who not only may establish pricing and availability but who also owns a thriving systems business—makes PC manufacturers understandably nervous. Even Compaq, despite its place at the head of the top tier of Intel's customers, has long been known to feel an occasional twinge at Intel's role as Compaq's sole microprocessor supplier.

BASICALLY, ACE specifies an interoperable, multiple-platform hardware/software scheme. If all goes as planned, ACE will allow users to mix and match ostensibly standardized systems from ACE-compliant vendors of Intel 80x86-based PCs, DOS or OS/2 PC operating-system applications, Unix applications, and RISC (reduced instruction set computer) system hardware based on Mips Computer Systems' RISC microprocessor. ACE's RISC workstations would run any of thousands of today's software packages in millions of DOS and OS/2 PCs. And Intel 80x86-based PCs could run engineering and graphics applications designed to run on Unix-based workstations such as those designed with the Mips RISC microprocessors.

That flexibility makes ACE "one of the most important things that has happened in the [computer] industry," says Silicon Graphics CEO Edward McCracken, since it would leave no one vendor a dominant market force. It also is a step toward what the industry has been rhapsodizing about for years: truly open systems.

The war of the words is bound to heat up. Sun is aggressively and successfully besieging the commercial market, which until now bought minicomputers or PCs. The workstation, in other words, is not just for engineers anymore. PC maker Compaq, meanwhile, bought an equity stake in Silicon Graphics, which is highly regarded for its capabilities in 3-D graphics workstations, giving Compaq expertise in a totally new area. In the process, Compaq also bought into Mips Computer Systems' part of the RISC world because Mips provides chips to Silicon Graphics. Compaq would have been happy to acquire Silicon Graphics lock, stock, and barrel and may later try to increase its holdings.

Compaq certainly needed an upward migration path to escape the price pressure in the clone market. Indeed, shortly after the ACE consortium was announced, Compaq cut its prices then announced reduced quarterly earnings.

There were other RISC architectures from which Compaq could have chosen—primarily, the Sparc architecture, which is promoted by Sun and which dominates the RISC market. Compaq could not, however, be expected to buy its bullets from the enemy camp. Licensed to multiple silicon vendors for manufacturing, Mips's well-regarded architecture gives Compaq access to volume production at competitive pricing with a quality image.

Mips, itself, is seen as having concluded a major coup with ACE; the company was losing ground to Sparc and could have ended up with little more forward momentum. Now that Compaq has jumped, Mips's silicon vendors are cheering as they hear the telephones ring with calls from other PC vendors. However, Mips has not yet succeeded in emerging beyond its role as premier architecture licenser to gain recognition as an OEM systems house. In that endeavor, DEC's stake in Mips may be both a blessing and a curse. DEC has provided money and a home for a specially engineered version of Mips's chips, but DEC can reason-

How Wall Street sizes up ACE

The bulls and the bears are running rampant on Wall Street as financial analysts assess the market impact of the ACE initiative. Here's what a few prominent analysts have been saying:

Thomas P. Kurlak,
Merrill Lynch Capital Markets

"Ace will be a major success," says Kurlak, Merrill Lynch's semiconductor expert. "It is being panned now, but that is a knee-jerk reaction by people who just haven't done the analysis."

Kurlak predicts success for ACE for several reasons. First, Microsoft's involvement is a big plus. Second, "both Gates [CEO of Microsoft] and Canion [CEO of Compaq] say they are interested in ACE to provide an upgrade path for their customers," and the idea of listening to the customer could motivate the success of ACE. Finally, adds Kurlak, the desktop market is becoming saturated and even users of 486-based PCs are looking at workstations. "With ACE, customers won't have to compromise their software investments," explains Kurlak. "Everyone wins with ACE. Software makers win, customers win, and hardware makers win. That is why ACE will succeed." □

Mark D. Stahlman,
Alex, Brown & Sons Inc.

Stahlman is a bit more pessimistic about ACE. "Most of the companies involved in ACE have their own agendas," says Stahlman. "What they all have in common is that they currently have small roles to play in the new growth industry—workstations. Each is being forced to play catch-up. That is never a good place to be." He notes that the ACE players will never achieve a dominant role, so they must determine their secondary roles and positions for the eventual shakeout in the workstation market that will occur in 1995 or beyond. Who will lose under ACE? "The entire PC industry," claims Stahlman. The most important thing about the ACE initiative, he says, "is what it tells us about current sales patterns and customers' wants. The move to open systems is continuing to build momentum." □

Laura Conigliaro,
Prudential-Bache Capital Funding

Conigliaro keeps Sun Microsystems in the win column in her assessment of ACE, at least in the short run. "I have absolutely nothing bad to say about Sun," she says. "The ACE announcement is an affirmation of their highly successful strategy." Other winners include ACE participants Silicon Graphics, "because they now have lots of cash with which to do lots of different things," and Mips Computer Systems. Without ACE, says Conigliaro, "Mips would have had to rethink their business strategy entirely. With ACE, their business model stays intact and has credibility and a foundation that it didn't have before." As for losers, Conigliaro agrees with Stahlman that PC makers have the most to lose. If ACE is successful, PC makers will see lower margins and a cut in revenue growth potential. "Distributed computing is going to be a very crowded market," she says. "Digital Equipment, Hewlett-Packard, and other companies that haven't built up enough momentum are at greater risk over the long term." But, Conigliaro qualifies, the PC market will not be impacted greatly by ACE in the short term. The problems for PCs will loom larger two or three years down the road. □

Mel Phelps,
Hambrecht & Quist

Here's the first take on ACE winners and losers from Hambrecht & Quist as reported in the company's Apr. 17 report: Winners include Compaq Computer because "the application portability between the Mips and Intel environments should yield a more favorable component pricing landscape for Compaq and others." Mips Computer Systems is "the big winner" because the ACE initiative offers potential for high unit volume sales of processors that did not exist before ACE. Silicon Graphics, as a technology enabler for both Compaq and Microsoft, also makes it into the win column because "the agreements provide significant incremental revenue to Silicon Graphics."

Potential losers under a successful ACE environment include Digital Equipment, Sun Microsystems, and Intel (the "major loser"). Says the Hambrecht & Quist team, "The highly likely success of ACE will make it more difficult for Sun to penetrate the commercial market." However, "even a modest penetration of the commercial market would make a significant incremental contribution to Sun's growth as the market is much larger and commercial sales account for only 15% of Sun's current sales." So Sun may lose some growth potential under a successful ACE deal, but not enough for Hambrecht & Quist to downgrade Sun's stock.

—Elizabeth B. Baatz

ACE participants

The worldwide leaders in the computer systems market participating in the initiative include:

- The Acer Group
- Compaq Computer
- Control Data
- Digital Equipment
- Kubota Computer
- Microsoft
- Mips Computer
- NEC
- NKK
- Olivetti
- Prime Computer
- Pyramid Technology
- The Santa Cruz Operation
- Siemens AG/Automation
- Siemens Nixdorf Informationsysteme AG
- Silicon Graphics
- Sony
- Sumitomo Electric
- Tandem Computers
- Wang Laboratories
- Zenith Data Systems

ably be expected to have a strong influence on Mips's future in the systems business, DEC's home turf.

Most of the other participants in the original ACE announcement are refugees from a dying minicomputer market. Companies that have built strong sales and support teams around proprietary minicomputer sales may be salvaged if their executives can core out the outdated proprietary innards and transplant in new open systems architectures that customers now demand.

THE DEBATE ABOUT who will win in the ACE consortium will go on for some time. The survival of ACE itself, however, will depend largely on how DEC and Compaq maintain their separate market orbits. Only a few weeks after ACE's birth, DEC teamed up with Intel to introduce a "PC workstation" family, a move hardly conducive to Compaq's peace of mind. Intel is, once again, competitor and supplier.

Another competitor in the workstation market is Hewlett-Packard Co., which has moved beyond the minicomputer attitude prevalent in earlier years to capitalize more successfully on its RISC architecture. HP had earlier introduced one of the first commercial RISC operating systems but had not exploited that market; in the end, it is not so much the technical brilliance of an architecture that counts, but its successful commercialization. Most of the existing high-end operating systems and chips were developed by a core group of engineers who have migrated from one company to another over time.

While hardware vendors hope to convince users that their computers are faster, and chip designers in turn try to convince computer manufacturers that their RISC chip is easier to incorporate into their designs, many industry insiders say that the technical superiority isn't what will make or break ACE. "Many of the same people worked on the Mips architecture, HP Precision Architecture-PA, and Sparc, so they are all good," says a high-level systems developer who was instrumental in creating HP's RISC architecture. All of these implementations are good enough to become the standard, he adds, but volume, price, marketing, and hardware applications will determine who wins out.

The final element of the ACE consortium is the impetus coming from the software market. The involvement of Microsoft is utterly crucial to the success of Compaq's crossover strategy. Microsoft has successfully grown its stake in the computer industry to the point that its success has, to some extent, overshadowed that of its far mightier partner, IBM. Indeed, there is evidence of growing strain in that relationship as Microsoft forges ahead with its own operating systems. IBM is also a competitor to many within ACE, both on the RISC workstation and on the PC side of the equation. Microsoft owns an equity stake in The Santa Cruz Operation, the privately held company charged within ACE with the monumental task of bridging the operating system gap between the DOS world of the PC and the Unix world of the workstation.

Yet even mighty Microsoft cannot meld the PC and workstation software markets without the cooperation of independent software developers, "the king makers of the future," according to Roger Ross, CEO of Ross Technology, a subsidiary of Cypress Semiconductor that makes and markets Sparc chips.

All in all, the ACE consortium is a motley bunch, consisting of companies small and large, successful and struggling, private and public. Chips, systems, and software businessmen alike are all seeking combinations to a puzzle that will unlock market growth, and they are willing to shake hands with old enemies or infuriate old allies to do it. There's no lack of opinion about who will win and who will lose. Only one vision really emerges: No one is going to see the computer industry in quite the same way again.

—Additional reporting by Lisa Stapleton

The battle for the desktop

As Compaq, Sun, and others look for new markets, the line between workstations and PCs gets even blurrier

By Dave Webb

When Compaq Computer Corp. CEO Rod Canion realized two years ago that PCs alone could no longer sustain the company's stellar growth record, he revised Compaq's strategy by targeting a wider swath of the commercial systems market. And when Sun Microsystems Inc. CEO Scott McNealy came to see last year that Sun's technical-workstation market was similarly restricted, he set out to chart a new market based on commercial applications.

Those decisions have put the two players in OEM desktop computers on a collision course. Hoping to restore blistering revenue growth and fat profits, each is eyeing the other's technology with the intent of combining and leveraging them to address the feverish demand for interoperable, open systems. The result: The line between workstations and PCs is becoming even blurrier.

By moving into workstation architectures, Compaq CEO Rod Canion expects that the company will eventually double in size

Compaq's RISC (reduced instruction set computer) strategy is now clear: The company is navigating beyond the hotly competitive, commodity-bound PC market by heading up a group of system hardware, software, and chip companies that have pledged allegiance to a desktop computing standardization plan known as the Advanced Computing Environment (ACE) initiative.

But Compaq's foray into higher-end commercial systems markets could be derailed. The initiative is disheveled in its specifics of software standards compliancy. Independent software developers are reluctant to start on ACE-compliant application packages simply because the initiative doesn't designate a single operating system. Digital Equipment Corp. supports its Ultrix version of Unix, for example, while Silicon Graphics Inc. will support its own operating system; and others drift toward support of Unix System V.4. Likewise, developers must worry about whether to develop applications for OS/2 3.0, which isn't available yet, or begin working on Windows 3.0 applications, though it isn't clear how much support Microsoft will give ACE through Windows.

THE NEW RULES of the desktop game aren't limited to Compaq and Sun. Vendors from both the $36 billion PC market and the $7.3 billion workstation market also are shifting strategies to accommodate high-end commercial accounts, largely in re-

sponse to revenue-limiting dynamics of their respective markets. Two months ago, for example, DEC announced a new line of PCs based on Intel Corp.'s 80486, with workstation-equivalent graphics capabilities. Until that time, the main distinction between workstations and PCs was that the former were powerful enough to easily handle complex graphics, particularly in three dimensions. (Interestingly, at DEC's May press conference, their PCs displayed "PC Workstation" on their screens.)

Compaq's migration into the RISC world appears to target commercial mainframe and minicomputer users who might replace those larger, more expensive systems with cheaper, almost-as-powerful networked desktop systems. The idea is to leverage not just existing investments in older systems, but also the mindsets of users who are used to working with Unix rather than Microsoft's DOS. "You have to accommodate not only the installed base, but history, in a sense, because of the commitment to different existing operating systems and application platforms," says Canion. "Customers have invested in Unix as solutions and aren't going to switch to PCs. They are committed to one or the other."

Digital Equipment at a glance

Sales (millions)	$12,943
Profits (millions)	$74
Cost of goods/sales	52.5%
R&D/sales	12.5%
Capital expenditures/sales	7.9%
Employees	124,000

All figures for fiscal year ended Jun. 30, 1990

Source: Company reports

Compaq wasn't seeking a RISC solution when the company embarked upon the plan to target large commercial accounts. "Our path led us to RISC," says Canion. "We began to learn what customers were really looking for in commercial systems applications, and it involved going beyond just PCs."

But ask anyone at Sun if they are worried about ACE, and you're likely to get a shrug. "I don't see this as a tangible threat," says Bill Keating, Sun's director of corporate technology marketing, who says that ACE is similar to the "rhetoric" surrounding the Open Software Foundation's standards initiative in 1988. "OSF backed down from those objectives," he says, and he expects similar disunity among ACE participants.

Sun has made it clear in the past year it means to use its own RISC architecture (called Sparc) to target high-end commercial application markets with a missionary zeal. The company has already grown commercial revenues to more than 30% of total sales. But because Sun faces competitive pricing at the high end, as well as the low end, of the workstation market (IBM chopped RS/6000 workstation prices, for example, and Hewlett-Packard's price/performance campaign portrays Sun as offering less bang for the buck), Sun may be forced to cut prices or unveil new higher-performance products.

Keating shrugs off the competitive pricing heat. "All we want to do is keep prices at the same level while continuing to offer new generations of products with higher and higher performance," he says. "That's all customers really ask."

Other Sparc proponents claim that ACE simply validates the direction in which Sun and Sparc International were already guiding the marketplace with their open, licensable architectures and interoperability. Sparc International chairman Bob Duncan says there are over 3,000 shrink-wrapped applications that run on Sparc, and many are non-technical applications popular with DOS PC users. Lotus Development Corp.'s 1-2-3 spreadsheets and WordPerfect Corp.'s word-processing programs have been ported to Sun OS (the operating system licensed through Sun's recent Sunsoft Inc. spinoff). More than 30 system vendors, mostly Asian, are now manufacturing and marketing Sparc-compatible products. Less than a dozen vendors are marketing OEM systems based on microprocessors from ACE player Mips Computer Systems.

Compaq Computer at a glance

Sales (millions)	$3,599
Profits (millions)	$455
Cost of goods/sales	57.2%
R&D/sales	5.2%
Capital expenditures/sales	9.0%
Employees	11,400

All figures for fiscal year ended Dec. 31, 1990

Source: Company reports

IBM at a glance

Sales (millions)	$69,018
Profits (millions)	$6,020
Cost of goods/sales	44.5%
R&D/sales	9.5%
Capital expenditures/sales	9.4%
Employees	373,816

All figures for fiscal year ended Dec. 31, 1990

Source: Company reports

THE ACE INITIATIVE generates a certain credibility by virtue of its membership: Among its 21 core supporters are DEC, Microsoft, Mips Computer Systems, Acer Inc., Silicon Graphics, The Santa Cruz Operation (which is making the DOS-to-Unix portability largely possible), Tandem Computers, NEC Corp., Zenith Data Systems/Groupe Bull, Sony, Siemens Nixdorf Informationssysteme, Pyramid Technology, Wang Laboratories, and Prime Computer.

Still, some sources argue that the diversity will prove to be a handicap. "How can anyone develop anything when the ACE principals can't agree on a single operating system?" asks Duncan. DEC already claims ACE compliance with its latest generation of Series 5000 workstations designed around Mips's R3000 chip. Fully compliant products from DEC and others based upon ACE specifications aren't expected until 1992 at the earliest.

The initiative

Getting ACE into the customer's hands

IN THE BATTLE for sales, selling a PC is a quick strategic strike, says Seymour Merrin, a distribution analyst and president of Merrin Information Services Inc. in San Francisco. PC dealers make a fast foray into the market and offer the lowest price possible; the consumer either buys from that dealer or walks down the street to the next one.

On the other hand, selling workstations is more like laying a siege. "You have to camp out on the customer's doorstep in order to fight off competitors," Merrin says. A workstation reseller often has to have networking expertise, the ability to tie in the new hardware with customers' previously purchased units, and, finally, the capacity to integrate specialized software to produce a total solution for a corporate customer.

Sun's Candia: Using PC resellers to sell workstations is tough

Setting up distribution is a particularly acute problem for ACE members such as Compaq Computer Corp., Zenith Data Systems Corp., and Acer Inc. All three traditionally have sold their PCs through dealers and distributors, and they lack the experienced resellers that are available to workstation vendors.

AS A RESULT, ACE strategists are trying to divine the best method for getting their workstations into the hands of customers. In general, they have only two options: Either they must bring their storefront dealers up to speed in terms of selling higher-end products, or they must align themselves with new partners who are already experts in workstations.

With ACE-based products scheduled to appear in 1992, however, the PC-oriented companies don't have much time to become experienced workstation vendors. Xavier Candia, manager of channel development at Sun Microsystems Inc., knows firsthand the difficulties that Compaq and other ACE members will have using PC resellers to sell workstations.

"It requires a lot of investment in training and creating a support infrastructure for the dealers out there," according to Candia, who has spent the past five years building a distribution network for Sun. It can take from 6 to 12 months to get a reseller sufficiently trained to sell workstations, he says. It also takes time to find the few good VARs and dealers capable of making it through such grueling basic training.

Moving up to begin selling workstations is hard work for any dealer. The Businessland Inc. chain, for example, has sought to transform itself from a pusher of stand-alone PCs into a deliverer of value-added networking and systems integration services. But it has been a painful process. The retail chain has had five consecutive quarterly losses during the transition.

If ACE products appear in 1992, PC vendors won't have time to become skilled workstation vendors

Nor can most computer dealers, with their razor-thin margins, afford to invest today for sales tomorrow. ACE members wanting to set up adequate distribution for their new products are going to have to invest time and money in helping their retailers.

Spurred on by such critiques, Compaq started improving the support that dealers give to their customers even before the ACE announcement. In February Compaq announced a Specialized Dealer Program designed to identify dealers for those customers that require advanced connectivity solutions. Instead of handing out a list of local dealers for a potential customer, the company recommends those specialized dealers when customers require more complex solutions.

TO BECOME A MEMBER of this subset of Compaq's authorized dealers, a reseller must have achieved an advanced designation from one or more of the PC network software companies (Novell, SCO, Microsoft, Banyan), have a Compaq-accredited systems engineer on staff, offer on-site service and support, and carry a specific inventory level of Compaq equipment.

As of May, Compaq had signed up about 40 of its estimated 400 U.S. dealers for the program, and the company projects that it will authorize about 20% of its dealers by year-end, says Doug Johns, Compaq's vice president of corporate marketing.

While Compaq says it is only in the process of drawing up distribution plans for its ACE products, Johns does say the company will be pragmatic and flexible. "We recognize that the model of distribution we used in the '80s may or may not be exactly the right model for the '90s," he says. "We are going to be open in our approach. This is *terra incognita* for us."

—By Jenny McCune

has solidified a large chunk of the nonproprietary RISC workstation market opposite the Sparc clone contingent. IBM and HP, the other two significant workstation market shareholders next to Sun and DEC, don't license their RISC system architectures to the open market. While Sparc supporters scoff at the Mips coalition under ACE (which was largely in place before Compaq's April commitment to the technology), ACE vendors say Sparc is too rigidly controlled by Sun, especially through Sun OS.

"Sparc is Sun-dominated," says Edward McCracken, Silicon Graphics Inc.'s president and CEO. "We've never viewed Sparc as being really open. ACE is built around the Mips architecture, [and as a consequence] I think you'll see 50 to 100 companies adopting Mips in the next year."

ACE also promises to provide PC makers such as Dell Computer Corp. and AST Research Inc. (neither of which to date has announced support or alignment with ACE) an avenue of migration into ostensibly higher-performance yet similarly priced RISC-based systems. Since the only requirements ACE places upon companies wanting to conform are nondisclosure affidavits to platform specifications and a Mips RISC architecture license, PC market competitors such as Dell, AST, and Advanced Logic Research Inc. can easily become ACE players. They may have to make a commitment to RISC in other ways, such as adopting Sun's Sparc architecture.

ACE certainly doesn't spell the end for Intel-based PCs, which are criticized for not having the graphics and multitasking capabilities workstations can offer at competitive prices. But ACE still assumes the viability of 80x86 as much as that of Mips's RISC architectures while promising users software applications that would run equally well on both platforms. "The mainline business in PCs is the Intel architecture," says Acer president Leonard Liu, "and it will continue to be so for a long, long time to come."

But Allan Snell, Solbourne Computer Inc.'s vice president of marketing, believes the collision between PC and workstation architectures is likely to occur on Intel architecture turf, not in RISC workstation segments. The market for engineering applications is close to being saturated, leaving commercial applications the obvious field of battle. "There's going to be an overlapping of workstation and PC applications in the $5,000 to $10,000 arena," says Snell. "Unix is migrating to the PC world, not the other way around."

And PC market dynamics are a big factor in Compaq's expansion strategy. Compaq, like IBM, Apple, and several other PC vendors, had to do something to continue growth, and quickly. The PC market in the last half-year has become a hotly competitive, price-pressured market across all segments, even the rapidly growing one for notebooks. All of the major 80x86 PC vendors—IBM, Compaq, and a raft of others—have cut prices so aggressively that they are chewing up once-vaunted gross margins in the 60% range.

"Those days are gone," says Bill Lempesis, editor of the *Lempesis Report*, a PC industry newsletter in Pleasanton, Calif. "I don't see any segment of the PC market today being overly lucrative." Compaq itself cut prices up to 30% earlier this year, rolling out its new market share pricing strategy. Even Apple, which gained a reputation for cockiness over its ability to sell its Macintoshes at high prices and retrieve the highest margins in the business, is playing the price-competitive market share game. It rolled out cheaper, more functional versions of much of its existing product line last fall and has been falling over itself to keep up with demand ever since.

What this means is that PC manufacturers are faced with a commodity-style market that is likely to not only stunt company growth, but force a number of vendors out of the business. "A lot of them have already come to the conclusion that they just can't make any money in the PC market," Lempesis says.

Compaq's move into workstation architectures supports that hypothesis. Canion says Compaq projects a "big forecast of growth" as a result of targeting large commercial systems users. Short of predicting just what that means in quantitative terms, Canion expects to double the size of his company "over time."

"There is a lot of potential there. The PC market will continue to grow, and we expect many years of PC growth to come," Canion says. "[But] we view this as an opportunity for Compaq to grow in a newly emerging portion of the industry." □

Hewlett-Packard at a glance

Sales (millions)	$13,233
Profits (millions)	$739
Cost of goods/sales	52.8%
R&D/sales	10.3%
Capital expenditures/sales	7.2%
Employees	92,000

All figures for fiscal year ended Oct. 31, 1990

Source: Company reports

Silicon Graphics at a glance

Sales (millions)	$420
Profits (millions)	$32
Cost of goods/sales	45.1%
R&D/sales	10.9%
Capital expenditures/sales	7.1%
Employees	2,099

All figures for fiscal year ended Jun. 30, 1990

13% equity owned by Microsoft

Source: Company reports

Sun Microsystems at a glance

Sales (millions)	$2,466
Profits (millions)	$111
Cost of goods/sales	56.7%
R&D/sales	12.2%
Capital expenditures/sales	8.6%
Employees	11,490

All figures for fiscal year ended Jun. 30, 1990

Source: Company reports

RISC chips head for the mainstream

With ACE taking aim at its traditional dominance in microprocessors, Intel digs in to defend its position

By Teri Sprackland

One of the most logical questions surrounding the birth of the Advanced Computing Environment (ACE) alliance is how the young consortium may ultimately impact the nation's semiconductor makers.

The answer, not surprisingly, depends on who you ask. "[ACE] is a tempest in a teapot," scoffs David House, president of Intel Corp.'s Microcomputer Components Group in Santa Clara, Calif., in dismissing the importance of ACE's adoption of Mips Computer Systems Inc.'s reduced instruction set computer (RISC) architecture.

Other sources take ACE more seriously. "ACE is a slap in the face to Intel," notes Rikki Kirzner, senior industry analyst at Dataquest Inc. in San Jose. What ACE really signifies, she says, is that PC maker and ACE cornerstone Compaq Computer Corp. has recognized its need to grow rapidly into higher-performance workstations in order to evade its PC competitors and has embraced Mips's RISC architecture to do it. In essence, says Kirzner, Compaq has decided that "[Intel's] plans for next-generation 586 and 686 chips are great, but Intel isn't getting there fast enough."

ACE participants tout their collaboration as one that allows PC and workstation makers to use either Mips's RISC architecture or Intel's popular 80x86 family of complex instruction set computer (CISC) chips. Despite House's breezy brush-off, that's a serious challenge to Intel, which until now has been the only PC microprocessor in town. Predictably, the company has already moved to put a few dents in ACE. Before the glow of ACE's April birthday party had faded, in fact, Intel CEO Andrew Grove was shaking

Mips's president and CEO Robert Miller declines to specify future chips' direction, saying that "where we go from here is not clear"

Mips Computer at a glance

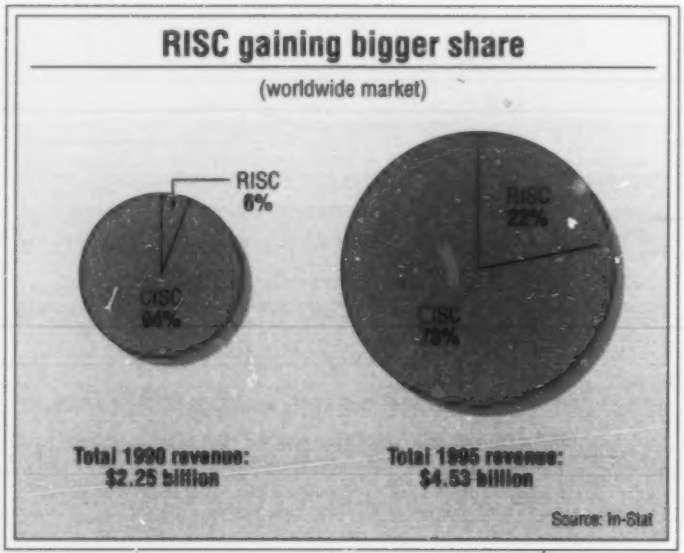
Sales (millions)	$152
Profits (millions)	$7
Cost of goods/sales	44.2%
R&D/sales	18.3%
Capital expenditures/sales	16.9%
Employees	777

All figures for fiscal year ended Dec. 31, 1990
5% equity owned by DEC
18% equity owned by Kubota Corp.

Source: Company reports

hands in a new deal with ACE cofounder Kenneth Olsen, CEO of Digital Equipment Corp. The May move by DEC and Intel puts a new "PC workstation" product on the market, running on Intel 80486 chips and graphics components from DEC.

The ACE consortium is an effort to pull together a viable competitor to Sun Microsystems Inc.'s RISC microprocessor (called Sparc), says Roger Ross, president and CEO of Ross Technology Inc., a subsidiary of Cypress Semiconductor. He considers Compaq's choice of Mips's chip over Sun's as a reasonable business decision because of Sun's aggressive play for Compaq's high-end commercial market. "Compaq did exactly what I would do if I were competing against Sun," says Ross. "Sun is now on their horizon as a long-term threat. [In that situation], Sparc would not be my primary weapon or first choice."



ACE THUS REPRESENTS a move by Compaq and software giant Microsoft to see if the Mips architecture is a viable alternative to Sparc, says Ross. If it fails, he adds, "they will probably fall back on Sparc, or perhaps go to Hewlett-Packard. Neither [Compaq nor Microsoft] has burned any bridges." Given the growing success of Sun's RISC microprocessor, Sun represents something of a wild card for ACE. The company also has licensed its architecture to multiple chip vendors, such as Cypress Semiconductor and LSI Logic.

It isn't surprising that Intel's House would dismiss Mips as an alternative supplier, considering that there will be about 28 million Intel architecture systems in place this year, compared with only about 2,800 Mips architecture systems. According to Integrated Circuit Engineering Corp. in Scottsdale, Ariz., Intel will sell about 5 million 32-bit microprocessors (the 80386 and 80486 CISC chips) in 1991.

And ACE certainly will have little impact on the bulk of Intel's volume, since less than 5% of PC users will migrate into the workstation market, estimates analyst Kirzner. But

Today's systems companies want an upgrade path that won't lock them into one vendor

while Intel would be happy to supply the world with microprocessors, not every customer is happy buying microprocessors from one source that can set its own price. Systems companies are looking for an upgrade path that doesn't lock them into one vendor. And if even 1% of PC buyers opt for workstations, the switch will double the current size of the workstation market, according to Michael Slater, editor and publisher of *The Microprocessor Report* in Sebastopol, Calif.

Intel and its managers are by no means standing still. A round of reorganizations was brewing within the company in May, with the responsibilities for various product lines changing hands. Once the dust has settled, a new management team could lead Intel in new directions.

Meanwhile, the faster 50-megahertz version of Intel's leading product, the 80486 microprocessor, is in the works, with industry sources looking for next-generation 80586 samples within the next year. Although House will not comment on specific developments, he notes that Intel does not plan to disrupt its 80x86 family with an incompatible RISC chip. Therefore, any new developments must be downward-compatible with chips that are over a decade old.

At the heart of the ACE consortium is Mips, the little company that keeps licensing its heart out. ACE has been a long time coming for Mips, which has been perceived as losing steam in recent months to surging sales of Sun's Sparc. Indeed, ACE may have kept Mips from fading into the background with a host of other RISC players.

"We started on ACE with Microsoft over two years ago," says Mips president and CEO Robert Miller. "We thought that whoever was going to win this microprocessor battle was going to have to win the PCs, and Microsoft was the clear leader in PCs." After Miller had worked out the game plan, Microsoft and Mips were able to sell the plan to both companies' customers.

MIPS IS STILL unsuccessful at establishing itself as a contender in the systems business, but the company's RISC architecture gets high technical marks. On the systems side, Mips uses its own chip design fabbed by its partners to

build systems that are then sold on an OEM basis.

A key problem for Mips will be satisfying both its "big-endian" and "little-endian" architecture customers. The terms come from a tale out of *Gulliver's Travels*, about two countries that went to war over whether one should first eat the big end or the little end of an egg, and they refer to the the direction in which a microprocessor code is written (i.e., to support larger or smaller systems). Computers that use one system cannot understand computers that use the other.

Mips's architecture started out as big-endian but had to adjust to little-endian to provide chips to DEC. "That slowed down progress by a year and a half," notes Larry Jordan, vice president of marketing for Integrated Device Technology Inc. in Santa Clara, Calif., a longtime Mips semiconductor partner. And in its efforts to satisfy DEC, adds Ross of Ross Technology, Mips is trying to be all things to all people.

Mips's Miller declines to specify the direction for the company's future chips, saying that "where we go from here is not clear." For the moment, both options are available to customers. Mips's newest chip, the R4000, is about 90 days behind schedule, acknowledges Miller. He predicts that the first R4000 systems will be available by the first quarter of 1992.

VARIOUS OTHER FLAVORS of RISC abound, with many major semiconductor players in the market. Indeed, Motorola Inc. in Schaumburg, Ill., was once offered the opportunity to develop a RISC chip for Sun but stumbled in executing a successful early RISC strategy. Proponents of the Motorola 88000 RISC chip are now battling to regain recognition through the efforts of the 88Open industry group.

The big remaining question is when or even whether Intel will climb aboard the RISC bandwagon. House suggests that there is little incentive for the company to do so, given that the two leading RISC

Intel's House contends that "SparcStations are replacing VAXs, not PCs"

camps are simply feasting on the carcass of a dying minicomputer market. "SparcStations are replacing VAXs, not PCs," House claims. Whatever the reasons that customers are buying Sun's SparcStations,

The two leading RISC camps are feasting on the carcass of a dying minicomputer market

it is indisputable that the machines are showing up in commercial accounts as well as in their original technical engineering accounts. Sparc vendor Ross notes "a major uptick" in recent chip sales, both directly from Sun and from emerging SparcStation clone makers such as Solbourne in the United States, ICL in Europe, and Toshiba in Japan.

Ross predicts that within three years Intel will lose market share but gain in volume chip sales. By 1995, however, RISC chips of all kinds will account for 25% of the $4.2 billion market for the 32-bit marketplace, with 75% remaining in the hands of CISC vendors, says ICE. It is thus a seminal time for all chip makers—including Intel—as those with a RISC offering work and wait for the day when some of those volume sales cross the chasm between the Unix-workstation world and the DOS-PC world.

"Intel believes it can still establish a proprietary RISC standard," Ross says. "It will probably take them three years to learn better. Intel missed a magnificent opportunity to incorporate RISC on the 486, to turn it into a 'swing machine' that could keep their old base hooked while swinging into a new base."

But proprietary systems eventually run into problems. "Being proprietary shields you from the forces of the market," explains Ross. In quasi-monopolistic markets, he says, companies that cease developing new products soon atrophy. "They just rake it in with old cash cows and eventually founder when a company such as Sun aggressively brings out new products every 18 months." As a result, explains Ross, Intel could develop the problems that kept Motorola from being successful with its RISC introduction—a fierce internal war between the "cash cow people and the new-technology guys. Motorola became schizophrenic fighting enemies within."

The storm that is brewing on the horizon may be spattering only a few raindrops on Intel's parade today, but could indeed bring serious margin pressure and competition to the microprocessor giant. The world of the desktop computer, where PC and workstation differences have merged into a sequence of upward-compatible products based on a variety of microprocessors, is now more than a pipe dream. □

Intel at a glance

Sales (millions)	$3,921
Profits (millions)	$650
Cost of goods/sales	49.2%
R&D/sales	13.2%
Capital expenditures/sales	17.3%
Employees	23,900

All figures for fiscal year ended Dec. 31, 1990

Source: Company reports

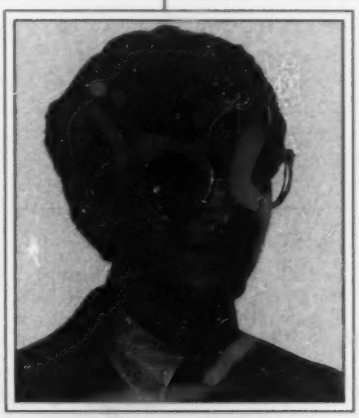
Building a PC/workstation software bridge

Despite a show of unity, each of the major software players in ACE has its own plan for the desktop market

By Dwight Davis and Rick Whiting

Look at the photos from April's unveiling of the Advanced Computing Environment (ACE) consortium and you see smiling executives, hands clasped in solidarity as they vow to create an open, industry-standard operating environment for desktop computers. But behind the photos are plots, hidden agendas, and alliances worthy of a Shakespearean play.

Holding center stage in the ACE drama is Microsoft Corp., the $1.5-billion software company that is developing OS/2 version 3.0 for PCs and workstations conforming to ACE specifications. Microsoft also holds a key equity stake in ACE player The Santa Cruz Operation Inc. (SCO) and is enmeshed in a critical software development alliance with Digital Equipment Corp.



Chairman Bill Gates hopes to maintain Microsoft's domination of the desktop through ACE

Microsoft at a glance

Sales (millions)	$1,183
Profits (millions)	$279
Cost of goods/sales	21.4%
R&D/sales	15.3%
Capital expenditures/sales	13.4%
Employees	5,635

All figures for fiscal year ended Jun. 30, 1990

Source: Company reports

All this, when added to its control of the ubiquitous DOS and Windows operating environment, gives Microsoft an unprecedented level of influence within the desktop computer industry. "If power is measured by the ability to set others' agendas, then Microsoft, despite its still relatively modest size, is now the most powerful company in the computer industry," wrote analyst Marc Schulman of UBS Securities Inc.

But Bill Gates and his management team peer into the future of the slowing PC market, they see a growth rate far below what the Redmond, Wash.-based company has become accustomed to. Microsoft is hoping that ACE will ignite demand for a more powerful system and application software.

Microsoft is gambling that ACE will spur sales of OS/2, the PC operating system that was the intended successor to DOS. But because of its complexity and expensive hardware requirements, market acceptance of OS/2 has been slow.

Microsoft's moves, however, put it on a very different path from that of IBM, straining the already rocky partnership that created the PC industry over a decade ago. IBM, which jointly developed the original version of OS/2 with Microsoft, is not an ACE participant and plans on debuting the next release of OS/2—version 2.0—later this year.

MICROSOFT AND IBM profess support of each other's OS/2 development efforts but still sound wary. "We still meet periodically with IBM to review the OS/2 specs and IBM maintains an OS/2 team in Redmond," says Carl Stork, Microsoft's advanced development business manager. "It's in both our interests to continue to work synergistically."

"If [Microsoft's] OS/2 3.0 is really OS/2, then it will meet our requirements," says an IBM spokeswoman, noting that IBM will closely monitor Microsoft's work. "If it doesn't meet our requirements, then it's not OS/2." Even more skeptical are such industry executives as J. Paul Grayson, chairman and chief executive of Micrografx Inc., Richardson, Tex. Micrografx is working with IBM to integrate Windows technology into OS/2 2.0. "IBM is not happy with the way Microsoft has positioned OS/2 3.0," Grayson says. "I think there will be a divergence within the OS/2 market."

SCO, the other major software vendor in ACE, markets versions of Unix for Intel-based computers. But the Santa Cruz, Calif., company's strength has always been in selling multiuser operating systems while having limited success marketing Unix for single-user desktop computers, says analyst John Logan of

the Boston-based Aberdeen Group Inc. SCO hopes to change that by having its Unix-based Open Desktop operating environment run on both ACE-compliant PCs and workstations based on RISC microprocessors from Mips Computer Systems Inc. in Sunnyvale, Calif.

The Santa Cruz Operation

Ownership	Privately held; Microsoft has 20% equity
Headquarters	Santa Cruz, Calif.
Founders	Father and son, Larry and Doug Michels
Employees	1,300
1990 sales (millions)	$107

Source: The Santa Cruz Operation

Despite the fact that Microsoft and SCO are both ACE members, and the fact that Microsoft owns a 20% equity stake in SCO, observers believe the two may be setting themselves up for a fight for control of the desktop.

Microsoft is betting that the stranglehold DOS has on the desktop will continue with Windows and OS/2. SCO has staked its business on the hope that Unix will become a mainstream desktop operating system. Certainly SCO has an uphill battle: While Open Desktop brings some 4,000 third-party applications to the table, Microsoft's OS/2 version 3.0 will support the more than 35,000 software programs already written for DOS, Windows, and OS/2.

SCO's president Larry Michels hopes that ACE will make Unix a mainstream desktop product

The wildcard in the ACE software scenario may be DEC. Software development alliances with Microsoft and SCO may provide substance to president Ken Olsen's oft-repeated claim that the Maynard, Mass.-based minicomputer maker is really a software company, not a hardware company.

DEC is working with Microsoft to adapt OS/2 to the Mips microprocessor architecture, a natural follow-on to DEC's experience with porting Ultrix (its own Unix implementation) to the Mips chip. But analyst Schulman believes that the collaboration goes much deeper and that there is evidence of "a massive technology transfer" between the two.

IN A REPORT, Schulman writes that DEC may be providing some of its significant expertise in multivendor networking to Microsoft and speculates that, in return, Microsoft will port OS/2 3.0 to a line of RISC-based VAX computers DEC is currently developing.

DEC is also aiding SCO's efforts to develop Open Desktop for ACE. Open Desktop will be based on the kernel of OSF/1, the Unix-based operating system being developed by the Open Software Foundation. DEC, in fact, has canceled its own OSF/1 development efforts, turned its work over to SCO, and plans to license the final product from SCO as a replacement for Ultrix.

The results? Open Desktop will support the 2,000 applications already written for DEC's Ultrix for RISC workstations, allowing those programs to run on ACE-compliant RISC computers. Because OS/2 3.0 will be a migration path for IBM's OS/2 2.0, VAX computers running OS/2 3.0 would provide DEC with a tool for wooing IBM customers. And DEC may at last shake the industry perception that it is "anti-Unix."

The irony of ACE is that the major benefactor of its software efforts may be a hardware company. □

A "unified" environment is anything but

Despite the perception that ACE will create a unified operating environment for desktop systems, the consortium, in fact, is creating four distinct environments encompassing two operating systems and two microprocessor architectures.

Microsoft Corp. is developing OS/2 version 3.0 for both the Intel Corp. 80x86 microprocessor line and Mips Computer Systems Inc. RISC microprocessors. Although OS/2 for Intel and OS/2 for Mips will be compatible at the source-code level, applications written for one microprocessor architecture will have to be recompiled in order to run on the other. The same will be true of the Intel-based version of Open Desktop, The Santa Cruz Operation Inc.'s implementation of Unix, and the version of Open Desktop SCO is developing for Mips microprocessor-based workstations.

The two ACE operating systems, however, are incompatible and even make use of different graphical user interfaces: Open Desktop uses the Motif interface from the Open Software Foundation (OSF) while OS/2 version 3.0 will use Microsoft's Windows interface.

Both ACE operating environments will include a high level of network interoperability through their support of the distributed computing environment specifications developed by OSF, the consortium dominated by IBM, Digital Equipment Corp., and Hewlett-Packard Co. Microsoft's OS/2 version 3.0 and Open Desktop are slated to support the Posix programmers' interface standard.

Software developer kits for each operating system are slated for availability later this year with general availability of the operating systems scheduled for 1992. □

Will Europe's protectionists yield to the free marketers?

With old solutions no longer working,
the EC looks for new ways to get electronics back on its feet

by Barbara N. Berkman

As the 1992 deadline for European economic integration approaches, the European Community's bureaucracy and its electronics industry are at odds.

Everyone agrees that the EC's share of the world electronics market is slipping. But attempts to inject new life into its electronics industry are hampered by a long-standing disagreement on three fundamental issues: state aid, industrial and social policy, and free-market principles.

The basic problem is that the electronics industry, national governments, and the Brussels-based European Commission don't share common goals. "There are conflicting views as to what [a united] Europe represents," explains George Hall, head of government relations at Britain's International Computers Ltd. While Europeans are generally committed to the concepts of 1992, he says, individual EC governments still hold wildly diverse views on the role of state aid in a free market.

In an effort to end the dispute once and for all, the Commission will lay the foundation of a pan-European electronics policy this month by issuing the first in a series of guidelines affecting European semiconductors, computers, telecommunications, and electronics research. Non-European companies will be watching closely for signs that all 12 EC member nations are beginning to abandon their protectionist policies in favor of improved product development cycles, more applied research, and better production methods. If so, non-European companies are expected to play leading roles in nursing European electronics back to health.

EUROPE'S ELECTRONICS market is complicated by several factors. For one, demand for computers and consumer electronics is depressed by high prices; computers and workstations in Europe are priced 40% to 50% higher than in the United States. Europe also lacks a big, deregulated market and a local, low-cost, U.S.-style components industry. Further plaguing the industry is Fujitsu's virtual takeover of ICL early this year; heavy 1990 losses by N.V. Philips, Groupe Bull, Siemens Nixdorf Informationssysteme, and Thomson S.A.; the floundering of Jessi (the Joint European Submicron Silicon Initiative, Europe's semiconductor consortium), and recent technical disputes that threaten European HDTV.

In the past, many European governments—especially in Italy and France—have propped up their industries with various forms of direct financial aid to ailing companies. It is no secret that the French government is determined that national companies such as Groupe Bull and Thomson survive even if they would be doomed in a free market.

Those anticompetitive policies no longer fly with the EC, which believes that European industry must

Despite aid from the European Community ...

EC funding programs for electronics ($ millions)*

Jessi (semiconductors)	
1989-1997	$4,000
Esprit (computers)	
Second round, 1987-1991	1,600
Third round, 1990-1994	1,352
European Nervous System (electronic networks)	
1991	380
Race (telecommunications)	
Second round, 1987-1991	550
Third round, 1990-1994	489
HDTV	
1986-1992	600
Total:	$8,971

*1 ECU per dollar Source: EC Commission

... the big five see income eroding

Company	1990 revenue ($ millions)	1990 net income ($ millions)
Olivetti	$771	$47
Philips	29,349	-2,210
Thomson	12,750	-414
Siemens Nixdorf	2,978	-227
Bull	5,970	-1,200

Source: Company reports

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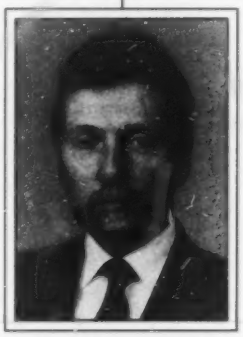
stand on its own or suffer the consequences. Policy makers increasingly suspect that their deep national divisions on state aid undermine any pan-European electronics policy. "What has been done in the past hasn't worked," says Roberto Schisano, president of Texas Instruments Europe. The debate now, he adds, is shifting to the real issues, such as global competitiveness, time to market, and the cost of capital differential between Europe, Japan, and the United States.

To put teeth into those issues, the Commission is moving to harmonize national industrial policies with a stronger pan-European competition policy, headed by Commissioner Leon Brittan. Brittan's best chance to thwart interventionism by individual EC governments may be to restrict the use of state aid.



"The next investments [in European electronics] will be from the U.S. and Japan," says ICL chairman Peter Bonfield

European industry has already had a taste of that medicine from the free marketers. Recently the EC chastised the Italian government for extending aid to electronics companies one year longer than sanctioned by Brussels; the Commission made auto maker Renault repay $1 billion in aid from the French government that was ruled illegal; France's $1.5 billion aid package to Groupe Bull set off an inquiry into anticompetition violations; and, in a landmark decision in April, the European Court of Justice ruled that the Commission can force member states to break up monopolies (particularly in telecommunications equipment) that block a unified market.

There have been other signs of change. The EC is putting more money into marketing studies and feasibility assessments to bring companies closer to market demands, notes Ellen Hipschman, executive consultant for KPMG Regis McKenna in London. In April, the chief executives of Europe's five largest electronics companies met with EC officials to discuss a blueprint for saving European components and computers. The CEOs' recommendations will likely include the need for cheap capital, improved manufacturing and product development processes, and cooperation—even with non-Europeans—between components makers and users.

Another approach is to re-energize Europe's electronics companies by stimulating demand. Last March, Brussels issued an electronics policy paper that urged Europeans to wean themselves from state aid and promised help by boosting demand for electronics goods.

One idea backed by Commissioner Filippo Maria Pandolfi is a proposed computer infrastructure project that would award massive contracts for computers, peripherals, and software that link EC countries. While this so-called European Nervous System could raise demand for computers, some critics call the exercise a pork-barrel approach that makes about as much sense as damming the English Channel in order to create construction jobs.

Pandolfi also mulled over a proposal by SGS-Thomson chairman Pasquale Pistorio to merge the semiconductor operations of SGS-Thomson, Siemens, and Philips. "It is better to have one European company than splinters," says Pandolfi. While that notion draws attention to Europe's biggest problem—lack of scale—such a merger is unlikely.

Also unlikely (at least for now) is Pandolfi's idea of a European consortium, similar to Airbus, for chips and computers. European companies, like their U.S. counterparts, do not thrive in such arrangements; the Commission concedes that Jessi has thus far been anything but a re-

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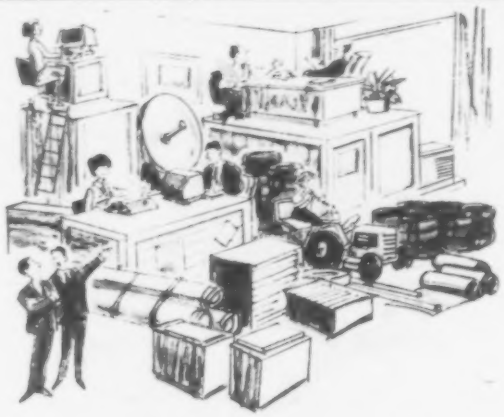

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sounding success. And current EC rules bar companies from entering cartel-like agreements that could restrict competition. That could change, however, if the Commission loosens its rules on cooperation.

FEW SOURCES WILL speculate on what all of this could mean to U.S. and other non-European electronics companies. But some, including TI's Schisano, see the move away from protectionism as a sign that cooperation with non-Europeans will be increasingly welcomed. As interventionist policies are slowly abandoned, European governments will be forced to open their traditionally closed public-procurement bidding processes to outsiders. The EC is determined to make the Jessi consortium more applications-driven, a process in which U.S. and Japanese semiconductor and systems companies are more experienced. "The next investments [in European electronics] will be from the United States and Japan," predicts ICL chairman Peter Bonfield. "Bull can't make mainframes without [technology from Japanese partner] NEC Corp., and we didn't make many good mainframes without Fujitsu."

That doesn't mean that European state aid is about to disappear entirely or that Europeans are happy to see their taxes supporting non-European competitors. Two years ago, for example, SGS-Thomson raised an international ruckus when the Italian government gave Texas Instruments $700 million to develop a DRAM fab in the depressed Mezzogiorno region.

It does mean that Europeans increasingly—reluctantly, perhaps—see international technology and marketing alliances as a key to the future of their electronics industry. The trick will be to structure those alliances so that a fair share of the payoffs will stay in European hands. "We don't want a 'Fortress Europe,'" says Pistorio. "But we don't want to sit down at the table with our partners and have nothing to eat." □